SEQUENCE LISTING

<110> BUTTCHER, Volker et al.

<120> Method for producing alpha-1, 6-branched alpha-1, 4-glucans from sucrose

<130> 0147-0253P

<140>
<141> 2003-11-10

<150> US 09/807,063
<151> 2001-04-09`

<160> 34

<170> PatentIn Ver. 2.1

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ccgccacccg caaatgggca agcagcttgc catgatggga gacatccgc atg aac cga 178
Met Asn Arg
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aac cgc cat atc cga cgc ggc tac cac ccg gaa gcc gga gaa cgc caa 226
Asn Arg His Ile Arg Arg Gly Tyr His Pro Glu Ala Gly Glu Arg Gln
5 10 15

atc atc gac agc ctg ttt gcc gcc acc cac agc gat ccg ttt gcc tat 274
Ile Ile Asp Ser Leu Phe Ala Ala Thr His Ser Asp Pro Phe Ala Tyr
20 25 30 35

ctt ggg cgg cat cgt gtc aac gac gaa cgc gaa gcc gtg cgc gtg ctg 322
Leu Gly Arg His Arg Val Asn Asp Glu Arg Glu Ala Val Arg Val Leu
40 45 50

cgt ccc gac gcg cac cac atc gac atc atc gac cgc cac aca ggc gca 370
Arg Pro Asp Ala His His Ile Asp Ile Ile Asp Arg His Thr Gly Ala
55 60 65

gtc atc atg ccg tct gaa aaa atc gac gag cgc ggc ctg ttt gcc gcc 418
Val Ile Met Pro Ser Glu Lys Ile Asp Glu Arg Gly Leu Phe Ala Ala
70 75 80

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gta ttg ccc gaa cac gcg ccc gac tac gcc ctg ctg gtg aca tac cac   466
Val Leu Pro Glu His Ala Pro Asp Tyr Ala Leu Leu Val Thr Tyr His
     85                  90                  95

gag ggc gaa gcc gcc gta cgc gaa gaa gat gac tac cgc ttc ggc agc   514
Glu Gly Glu Ala Ala Val Arg Glu Glu Asp Asp Tyr Arg Phe Gly Ser
100                 105                 110                 115

gcg ctg caa cat acc gat gcc tgg ctg ctg ggc gaa ggc acg cac ctg   562
Ala Leu Gln His Thr Asp Ala Trp Leu Leu Gly Glu Gly Thr His Leu
                120                 125                 130

cgc cct tat gaa acg ctg ggc gca cat ttc gcc gaa atg gac ggc gta   610
Arg Pro Tyr Glu Thr Leu Gly Ala His Phe Ala Glu Met Asp Gly Val
            135                 140                 145

tcc ggc gtg cgc ttt gcc gtt tgg gcg ccc aac gcg cgg cgg gta tcg   658
Ser Gly Val Arg Phe Ala Val Trp Ala Pro Asn Ala Arg Arg Val Ser
        150                 155                 160

gtc atc ggc gaa ttc aac ggc tgg gac agc cgc cgc cat gcc atg cgt   706
Val Ile Gly Glu Phe Asn Gly Trp Asp Ser Arg Arg His Ala Met Arg
    165                 170                 175

ccg cac aca ggc aac ggc ctg tgg gac atc ttt atc ccc ggc gtc ggc   754
Pro His Thr Gly Asn Gly Leu Trp Asp Ile Phe Ile Pro Gly Val Gly
180                 185                 190                 195

ctc aac gcg ctg tat aaa ttc tcc gta ctc gat gcc aac ggc aac atc   802
Leu Asn Ala Leu Tyr Lys Phe Ser Val Leu Asp Ala Asn Gly Asn Ile
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cgc gaa aaa gcc gac ccc tac gca ttc ggc gcg gag ctg cgc ccg acc   850
Arg Glu Lys Ala Asp Pro Tyr Ala Phe Gly Ala Glu Leu Arg Pro Thr
            215                 220                 225

acc gca tcc gtg gtg cgc ggc ttg ccg gcc aaa gcc gaa gcg ccc gct   898
Thr Ala Ser Val Val Arg Gly Leu Pro Ala Lys Ala Glu Ala Pro Ala
        230                 235                 240

ttc cgc cgc cgc gcc aac tcc gtg gaa gcg ccc atc agc att tac gaa   946
Phe Arg Arg Arg Ala Asn Ser Val Glu Ala Pro Ile Ser Ile Tyr Glu
    245                 250                 255

gtc cat ctc ggc tcg tgg cgg cgc aat ccc gaa aac aac tac tgg ctc   994
Val His Leu Gly Ser Trp Arg Arg Asn Pro Glu Asn Asn Tyr Trp Leu
260                 265                 270                 275

acc tac acg cag ctg gcc gac gaa ttg gtg aac tat gta aaa gac atg   1042
Thr Tyr Thr Gln Leu Ala Asp Glu Leu Val Asn Tyr Val Lys Asp Met
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ggc ttc acc cac atc gag ctg ctg ccc ttg tcc gaa tat ccg ttc gac   1090
Gly Phe Thr His Ile Glu Leu Leu Pro Leu Ser Glu Tyr Pro Phe Asp
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ggc tca tgg ggc tac caa gcc acc ggc ctg tat gca ccg acc agc cgc   1138
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ttc ggc tcg ccc gat gag ctg aaa gcc ctg att gac gcc gcc cac gcc   1186
Phe Gly Ser Pro Asp Glu Leu Lys Ala Leu Ile Asp Ala Ala His Ala
    325                 330                 335

gcc ggc atc agc gtg att ctc gac tgg gta gcg ggg cac ttc ccc acc   1234
Ala Gly Ile Ser Val Ile Leu Asp Trp Val Ala Gly His Phe Pro Thr
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gac gac cac ggc ctc aac acc ttc gac ggc acg gcg ctt tac gaa cac   1282
Asp Asp His Gly Leu Asn Thr Phe Asp Gly Thr Ala Leu Tyr Glu His
                360                 365                 370

gcc gac ccg cgc gaa ggc tac cat cag gat tgg aac acg ctg att tac   1330
Ala Asp Pro Arg Glu Gly Tyr His Gln Asp Trp Asn Thr Leu Ile Tyr
            375                 380                 385

aac ttc ggc cgc aac gaa gtc aaa aac ttc ctg cag ggc aac gcg ctc   1378
Asn Phe Gly Arg Asn Glu Val Lys Asn Phe Leu Gln Gly Asn Ala Leu
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tac tgg att gag cgt ttc ggc ttc gac ggc atc cgc gtg gac gcc gtg   1426
Tyr Trp Ile Glu Arg Phe Gly Phe Asp Gly Ile Arg Val Asp Ala Val
    405                 410                 415

gcc tcg atg att tac cgc aac tac tcg cgc aaa gac ggc gag tgg att   1474
Ala Ser Met Ile Tyr Arg Asn Tyr Ser Arg Lys Asp Gly Glu Trp Ile
420                 425                 430                 435

ccc aac cgc tac ggc ggc agc gaa aat ctg gaa gcc atc gcc ttt ttg   1522
Pro Asn Arg Tyr Gly Gly Ser Glu Asn Leu Glu Ala Ile Ala Phe Leu
                440                 445                 450

cgc caa acc aat gcc gtc tta aaa agc gaa aca ccc ggc gcc ggc tcg   1570
Arg Gln Thr Asn Ala Val Leu Lys Ser Glu Thr Pro Gly Ala Gly Ser
            455                 460                 465

ttt gcc gaa gaa tcg act tcc ttt gcc gac gta acc cgc gaa gcc ggc   1618
Phe Ala Glu Glu Ser Thr Ser Phe Ala Asp Val Thr Arg Glu Ala Gly
        470                 475                 480

ctg aac ttc gat ttc aaa tgg aat atg ggc tgg atg aac gac acc ctg   1666
Leu Asn Phe Asp Phe Lys Trp Asn Met Gly Trp Met Asn Asp Thr Leu
    485                 490                 495

cgc tat atg cag gaa gac ccc gtc cac cgc aaa tac cac cac ggc aaa   1714
Arg Tyr Met Gln Glu Asp Pro Val His Arg Lys Tyr His His Gly Lys
500                 505                 510                 515

atg aca ttc ggc atg atg tac caa tac agc gaa aac ttc gtt ctg ccc   1762
Met Thr Phe Gly Met Met Tyr Gln Tyr Ser Glu Asn Phe Val Leu Pro
                520                 525                 530

ctg tcg cac gac gaa gtg gta cac ggc aaa cgc tcg ctg ctg ggc aaa   1810
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        550                 555                 560

ggc ttt atg tac ggc ttc ccc ggc aaa aaa ctc cta ttt atg ggc aac   1906
Gly Phe Met Tyr Gly Phe Pro Gly Lys Lys Leu Leu Phe Met Gly Asn
    565                 570                 575

gaa ttt gcc caa ggc cgc gag tgg aat tat cag gaa gga ctg gat tgg   1954
Glu Phe Ala Gln Gly Arg Glu Trp Asn Tyr Gln Glu Gly Leu Asp Trp
580                 585                 590                 595

cat ctg ctc gac gaa gcg ggc ggc tgg cac aaa ggc gtg cag gat tat   2002
His Leu Leu Asp Glu Ala Gly Gly Trp His Lys Gly Val Gln Asp Tyr
                600                 605                 610

gta cgc gac ctg aac cac atc tac acc gcc cac gcc ccg ctc tac cag   2050
Val Arg Asp Leu Asn His Ile Tyr Thr Ala His Ala Pro Leu Tyr Gln
            615                 620                 625

ctc gac cag cag ccc gag ggc ttt gaa tgg ctg gtg gcc gac gac agc   2098
Leu Asp Gln Gln Pro Glu Gly Phe Glu Trp Leu Val Ala Asp Asp Ser
        630                 635                 640

gac aat tcg gta ttc gta ttc gag cgc cgc gac cgc gca ggc aac cgc   2146
Asp Asn Ser Val Phe Val Phe Glu Arg Arg Asp Arg Ala Gly Asn Arg
    645                 650                 655

atc atc gtc atc agc aac ttt acc ccg gtg gtg cgc gaa cac tac cgc   2194
Ile Ile Val Ile Ser Asn Phe Thr Pro Val Val Arg Glu His Tyr Arg
660                 665                 670                 675

ttc ggc gtc aac gcg ccc ggc cgc tat acc gaa atc ctg aat tcc gac   2242
Phe Gly Val Asn Ala Pro Gly Arg Tyr Thr Glu Ile Leu Asn Ser Asp
                680                 685                 690

cgc acg cag tat caa ggc agc ggc atc gca aac ggc gcg gac atc acg   2290
Arg Thr Gln Tyr Gln Gly Ser Gly Ile Ala Asn Gly Ala Asp Ile Thr
            695                 700                 705

gcg gaa aac gtg cct tcg cac ggc aaa gcg cag tcg ctg agc ctg acc   2338
Ala Glu Asn Val Pro Ser His Gly Lys Ala Gln Ser Leu Ser Leu Thr
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ctg ccg ccg ctg gcc acg gtc tat ctg tat cag aaa gcc gcg ccc gca   2386
Leu Pro Pro Leu Ala Thr Val Tyr Leu Tyr Gln Lys Ala Ala Pro Ala
    725                 730                 735

acg gaa att cag acg gcc ttg cgc gcc gac aag cag ccg gcg gta aaa   2434
Thr Glu Ile Gln Thr Ala Leu Arg Ala Asp Lys Gln Pro Ala Val Lys
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Phe Ala Tyr Leu Gly Arg His Arg Val Asn Asp Glu Arg Glu Ala Val
35 40 45

Arg Val Leu Arg Pro Asp Ala His His Ile Asp Ile Ile Asp Arg His
50 55 60

Thr Gly Ala Val Ile Met Pro Ser Glu Lys Ile Asp Glu Arg Gly Leu
65 70 75 80

Phe Ala Ala Val Leu Pro Glu His Ala Pro Asp Tyr Ala Leu Leu Val
85 90 95

Thr Tyr His Glu Gly Glu Ala Ala Val Arg Glu Glu Asp Asp Tyr Arg
100 105 110

Phe Gly Ser Ala Leu Gln His Thr Asp Ala Trp Leu Leu Gly Glu Gly
115 120 125

Thr His Leu Arg Pro Tyr Glu Thr Leu Gly Ala His Phe Ala Glu Met
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Asp Gly Val Ser Gly Val Arg Phe Ala Val Trp Ala Pro Asn Ala Arg
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Arg Val Ser Val Ile Gly Glu Phe Asn Gly Trp Asp Ser Arg Arg His
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Ala Met Arg Pro His Thr Gly Asn Gly Leu Trp Asp Ile Phe Ile Pro
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Gly Val Gly Leu Asn Ala Leu Tyr Lys Phe Ser Val Leu Asp Ala Asn
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Gly Asn Ile Arg Glu Lys Ala Asp Pro Tyr Ala Phe Gly Ala Glu Leu
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Arg Pro Thr Thr Ala Ser Val Val Arg Gly Leu Pro Ala Lys Ala Glu
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Ala Pro Ala Phe Arg Arg Arg Ala Asn Ser Val Glu Ala Pro Ile Ser
245 250 255

Ile Tyr Glu Val His Leu Gly Ser Trp Arg Arg Asn Pro Glu Asn Asn

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Tyr Trp Leu Thr Tyr Thr Gln Leu Ala Asp Glu Leu Val Asn Tyr Val
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Lys Asp Met Gly Phe Thr His Ile Glu Leu Leu Pro Leu Ser Glu Tyr
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Pro Phe Asp Gly Ser Trp Gly Tyr Gln Ala Thr Gly Leu Tyr Ala Pro
305                 310                 315                 320

Thr Ser Arg Phe Gly Ser Pro Asp Glu Leu Lys Ala Leu Ile Asp Ala
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Ala His Ala Ala Gly Ile Ser Val Ile Leu Asp Trp Val Ala Gly His
            340                 345                 350

Phe Pro Thr Asp Asp His Gly Leu Asn Thr Phe Asp Gly Thr Ala Leu
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Tyr Glu His Ala Asp Pro Arg Glu Gly Tyr His Gln Asp Trp Asn Thr
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Leu Ile Tyr Asn Phe Gly Arg Asn Glu Val Lys Asn Phe Leu Gln Gly
385                 390                 395                 400

Asn Ala Leu Tyr Trp Ile Glu Arg Phe Gly Phe Asp Gly Ile Arg Val
                405                 410                 415

Asp Ala Val Ala Ser Met Ile Tyr Arg Asn Tyr Ser Arg Lys Asp Gly
            420                 425                 430

Glu Trp Ile Pro Asn Arg Tyr Gly Gly Ser Glu Asn Leu Glu Ala Ile
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Ala Phe Leu Arg Gln Thr Asn Ala Val Leu Lys Ser Glu Thr Pro Gly
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Ala Gly Ser Phe Ala Glu Glu Ser Thr Ser Phe Ala Asp Val Thr Arg
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Glu Ala Gly Leu Asn Phe Asp Phe Lys Trp Asn Met Gly Trp Met Asn
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Asp Thr Leu Arg Tyr Met Gln Glu Asp Pro Val His Arg Lys Tyr His
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His Gly Lys Met Thr Phe Gly Met Met Tyr Gln Tyr Ser Glu Asn Phe
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Val Leu Pro Leu Ser His Asp Glu Val Val His Gly Lys Arg Ser Leu
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Leu Gly Lys Met Pro Gly Asp Cys Trp Gln Gln Phe Ala Asn Leu Arg
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Ala Tyr Tyr Gly Phe Met Tyr Gly Phe Pro Gly Lys Lys Leu Leu Phe
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Met Gly Asn Glu Phe Ala Gln Gly Arg Glu Trp Asn Tyr Gln Glu Gly
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Leu Asp Trp His Leu Leu Asp Glu Ala Gly Gly Trp His Lys Gly Val
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Gln Asp Tyr Val Arg Asp Leu Asn His Ile Tyr Thr Ala His Ala Pro
    610                 615                 620

Leu Tyr Gln Leu Asp Gln Gln Pro Glu Gly Phe Glu Trp Leu Val Ala
625                 630                 635                 640

Asp Asp Ser Asp Asn Ser Val Phe Val Phe Glu Arg Arg Asp Arg Ala
                645                 650                 655

Gly Asn Arg Ile Ile Val Ile Ser Asn Phe Thr Pro Val Val Arg Glu
            660                 665                 670

His Tyr Arg Phe Gly Val Asn Ala Pro Gly Arg Tyr Thr Glu Ile Leu
        675                 680                 685

Asn Ser Asp Arg Thr Gln Tyr Gln Gly Ser Gly Ile Ala Asn Gly Ala
    690                 695                 700

Asp Ile Thr Ala Glu Asn Val Pro Ser His Gly Lys Ala Gln Ser Leu
705                 710                 715                 720

Ser Leu Thr Leu Pro Pro Leu Ala Thr Val Tyr Leu Tyr Gln Lys Ala
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Ala Val Lys Asp Lys Gln Ala Lys Ala Lys
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gctttgagcg tggcagaaag caaagtcagc acgtcttccg cgctttgcgg catcaccgca 180

attttgcaga tgtccgcgcc gcagtcctcc atctgtttca gacggcatac gatttcttct 240

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gcatgcgcca cggcgcgccg gacggcggtt tcgccggaaa aaagctcgat atcgataatg 360

tcgggcaggc ggctttcaat cagcgagtcg agcagttcaa aataataatc gtccgaacac 420

gggaacgagc cgccttcgcc atgccgtctg aacgtaaaca gcagcggctt gtcgggcagc 480

gcgtcgcgga cggtctgcgt gtggcgcaat acttcgccga tgctgcccgc gcattccaaa 540

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ataacggtgt ttttgacggt caggctggtg tgcatggcgg ttgttgcggc tgaaaggaac 720

ggtaaagacg caattatagc aaaggcacag gcaatgtttc agacggcatt tctgtgcggc 780

cggcttgata tgaatcaagc agcatccgca tatcggaatg cagacttggc acaagccctg 840

tcttttctag tcagtccgca gttcttgcag tatgattgca cgacacgccc tacacggcat 900

ttgcaggata cggcggcaga ccgccggtcg gaaacttcag aatcggagca ggcatc atg 959
                                                                Met
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ttg acc ccc acg cag caa gtc ggt ttg att tta cag tac ctc aaa aca 1007
Leu Thr Pro Thr Gln Gln Val Gly Leu Ile Leu Gln Tyr Leu Lys Thr
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cgc atc ttg gac atc tac acg ccc gaa cag cgc gcc ggc atc gaa aaa 1055
Arg Ile Leu Asp Ile Tyr Thr Pro Glu Gln Arg Ala Gly Ile Glu Lys
         20   25   30

tcc gaa gac tgg cgg cag ttt tcg cgc cgc atg gat acg cat ttc ccc 1103
Ser Glu Asp Trp Arg Gln Phe Ser Arg Arg Met Asp Thr His Phe Pro
     35   40   45

aaa ctg atg aac gaa ctc gac agc gtg tac ggc aac aac gaa gcc ctg 1151
Lys Leu Met Asn Glu Leu Asp Ser Val Tyr Gly Asn Asn Glu Ala Leu

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                70                  75                  80

caa cgc aac tca tcc tta aaa gat atc gat atc gcg cgc gaa aac aac   1247
Gln Arg Asn Ser Ser Leu Lys Asp Ile Asp Ile Ala Arg Glu Asn Asn
            85                  90                  95

ccc gat tgg att ttg tcc aac aaa caa gtc ggc ggc gtg tgc tac gtt   1295
Pro Asp Trp Ile Leu Ser Asn Lys Gln Val Gly Gly Val Cys Tyr Val
        100                 105                 110

gat ttg ttt gcc ggc gat ttg aag ggc ttg aaa gat aaa att cct tat   1343
Asp Leu Phe Ala Gly Asp Leu Lys Gly Leu Lys Asp Lys Ile Pro Tyr
    115                 120                 125

ttt caa gag ctt ggt ttg act tat ctg cac ctg atg ccg ctg ttt aaa   1391
Phe Gln Glu Leu Gly Leu Thr Tyr Leu His Leu Met Pro Leu Phe Lys
130                 135                 140                 145

tgc cct gaa ggc aaa agc gac ggc ggc tat gcg gtc agc agc tac cgc   1439
Cys Pro Glu Gly Lys Ser Asp Gly Gly Tyr Ala Val Ser Ser Tyr Arg
                150                 155                 160

gat gtc aat ccg gca ctg ggc aca ata ggc gac ttg cgc gaa gtc att   1487
Asp Val Asn Pro Ala Leu Gly Thr Ile Gly Asp Leu Arg Glu Val Ile
            165                 170                 175

gct gcg ctg cac gaa gcc ggc att tcc gcc gtc gtc gat ttt atc ttc   1535
Ala Ala Leu His Glu Ala Gly Ile Ser Ala Val Val Asp Phe Ile Phe
        180                 185                 190

aac cac acc tcc aac gaa cac gaa tgg gcg caa cgc tgc gcc gcc ggc   1583
Asn His Thr Ser Asn Glu His Glu Trp Ala Gln Arg Cys Ala Ala Gly
    195                 200                 205

gac ccg ctt ttc gac aat ttc tac tat att ttc ccc gac cgc cgg atg   1631
Asp Pro Leu Phe Asp Asn Phe Tyr Tyr Ile Phe Pro Asp Arg Arg Met
210                 215                 220                 225

ccc gac caa tac gac cgc acc ctg cgc gaa atc ttc ccc gac cag cac   1679
Pro Asp Gln Tyr Asp Arg Thr Leu Arg Glu Ile Phe Pro Asp Gln His
                230                 235                 240

ccg ggc ggc ttc tcg caa ctg gaa gac gga cgc tgg gtg tgg acg acc   1727
Pro Gly Gly Phe Ser Gln Leu Glu Asp Gly Arg Trp Val Trp Thr Thr
            245                 250                 255

ttc aat tcc ttc caa tgg gac ttg aat tac agc aac ccg tgg gta ttc   1775
Phe Asn Ser Phe Gln Trp Asp Leu Asn Tyr Ser Asn Pro Trp Val Phe
        260                 265                 270

cgc gca atg gcg ggc gaa atg ctg ttc ctt gcc aac ttg ggc gtt gac   1823
Arg Ala Met Ala Gly Glu Met Leu Phe Leu Ala Asn Leu Gly Val Asp
    275                 280                 285
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atc ctg cgt atg gat gcg gtt gcc ttt att tgg aaa caa atg ggg aca   1871
Ile Leu Arg Met Asp Ala Val Ala Phe Ile Trp Lys Gln Met Gly Thr
290                 295                 300                 305

agc tgc gaa aac ctg ccg cag gcg cac gcc ctc atc cgc gcg ttc aat   1919
Ser Cys Glu Asn Leu Pro Gln Ala His Ala Leu Ile Arg Ala Phe Asn
                310                 315                 320

gcc gtt atg cgt att gcc gcg ccc gcc gtg ttc ttc aaa tcc gaa gcc   1967
Ala Val Met Arg Ile Ala Ala Pro Ala Val Phe Phe Lys Ser Glu Ala
            325                 330                 335

atc gtc cac ccc gac caa gtc gtc caa tac atc ggg cag gac gaa tgc   2015
Ile Val His Pro Asp Gln Val Val Gln Tyr Ile Gly Gln Asp Glu Cys
        340                 345                 350

caa atc ggt tac aac ccc ctg caa atg gca ttg ttg tgg aac acc ctt   2063
Gln Ile Gly Tyr Asn Pro Leu Gln Met Ala Leu Leu Trp Asn Thr Leu
    355                 360                 365

gcc acg cgc gaa gtc aac ctg ctc cat cag gcg ctg acc tac cgc cac   2111
Ala Thr Arg Glu Val Asn Leu Leu His Gln Ala Leu Thr Tyr Arg His
370                 375                 380                 385

aac ctg ccc gag cat acc gcc tgg gtc aac tac gtc cgc agc cac gac   2159
Asn Leu Pro Glu His Thr Ala Trp Val Asn Tyr Val Arg Ser His Asp
                390                 395                 400

gac atc ggc tgg acg ttt gcc gat gaa gac gcg gca tat ctg ggc ata   2207
Asp Ile Gly Trp Thr Phe Ala Asp Glu Asp Ala Ala Tyr Leu Gly Ile
            405                 410                 415

agc ggc tac gac cac cgc caa ttc ctc aac cgc ttc ttc gtc aac cgt   2255
Ser Gly Tyr Asp His Arg Gln Phe Leu Asn Arg Phe Phe Val Asn Arg
        420                 425                 430

ttc gac ggc agc ttc gct cgt ggc gta ccg ttc caa tac aac cca agc   2303
Phe Asp Gly Ser Phe Ala Arg Gly Val Pro Phe Gln Tyr Asn Pro Ser
    435                 440                 445

aca ggc gac tgc cgt gtc agt ggt aca gcc gcg gca ttg gtc ggc ttg   2351
Thr Gly Asp Cys Arg Val Ser Gly Thr Ala Ala Ala Leu Val Gly Leu
450                 455                 460                 465

gcg caa gac gat ccc cac gcc gtt gac cgc atc aaa ctc ttg tac agc   2399
Ala Gln Asp Asp Pro His Ala Val Asp Arg Ile Lys Leu Leu Tyr Ser
                470                 475                 480

att gct ttg agt acc ggc ggt ctg ccg ctg att tac cta ggc gac gaa   2447
Ile Ala Leu Ser Thr Gly Gly Leu Pro Leu Ile Tyr Leu Gly Asp Glu
            485                 490                 495

gtg ggt acg ctc aat gac gac gac tgg tcg caa gac agc aat aag agc   2495
Val Gly Thr Leu Asn Asp Asp Asp Trp Ser Gln Asp Ser Asn Lys Ser
        500                 505                 510
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gac gac agc cgt tgg gcg cac cgt ccg cgc tac aac gaa gcc ctg tac   2543
Asp Asp Ser Arg Trp Ala His Arg Pro Arg Tyr Asn Glu Ala Leu Tyr
    515                 520                 525

gcg caa cgc aac gat ccg tcg acc gca gcc ggg caa atc tat cag ggc   2591
Ala Gln Arg Asn Asp Pro Ser Thr Ala Ala Gly Gln Ile Tyr Gln Gly
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ttg cgc cat atg att gcc gtc cgc caa agc aat ccg cgc ttc gac ggc   2639
Leu Arg His Met Ile Ala Val Arg Gln Ser Asn Pro Arg Phe Asp Gly
                550                 555                 560

ggc agg ctg gtt aca ttc aac acc aac aac aag cac atc atc ggc tac   2687
Gly Arg Leu Val Thr Phe Asn Thr Asn Asn Lys His Ile Ile Gly Tyr
            565                 570                 575

atc cgc aac aat gcg ctt ttg gca ttc ggt aac ttc agc gaa tat ccg   2735
Ile Arg Asn Asn Ala Leu Leu Ala Phe Gly Asn Phe Ser Glu Tyr Pro
        580                 585                 590

caa acc gtt acc gcg cat acc ctg caa gcc atg ccc ttc aag gcg cac   2783
Gln Thr Val Thr Ala His Thr Leu Gln Ala Met Pro Phe Lys Ala His
    595                 600                 605

gac ctc atc ggt ggc aaa act gtc agc ctg aat cag gat ttg acg ctt   2831
Asp Leu Ile Gly Gly Lys Thr Val Ser Leu Asn Gln Asp Leu Thr Leu
610                 615                 620                 625

cag ccc tat cag gtc atg tgg ctc gaa atc gcc tga cgcacgcttc        2877
Gln Pro Tyr Gln Val Met Trp Leu Glu Ile Ala
                630                 635

ccaaatgccg tctgaaccgt ttcagacggc atttgcg                          2914
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Thr Arg Ile Leu Asp Ile Tyr Thr Pro Glu Gln Arg Ala Gly Ile Glu
             20                  25                  30

Lys Ser Glu Asp Trp Arg Gln Phe Ser Arg Arg Met Asp Thr His Phe
         35                  40                  45

Pro Lys Leu Met Asn Glu Leu Asp Ser Val Tyr Gly Asn Asn Glu Ala
     50                  55                  60

Leu Leu Pro Met Leu Glu Met Leu Leu Ala Gln Ala Trp Gln Ser Tyr
 65                  70                  75                  80

Ser Gln Arg Asn Ser Ser Leu Lys Asp Ile Asp Ile Ala Arg Glu Asn
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                85                  90                  95

Asn Pro Asp Trp Ile Leu Ser Asn Lys Gln Val Gly Gly Val Cys Tyr
            100                 105                 110

Val Asp Leu Phe Ala Gly Asp Leu Lys Gly Leu Lys Asp Lys Ile Pro
        115                 120                 125

Tyr Phe Gln Glu Leu Gly Leu Thr Tyr Leu His Leu Met Pro Leu Phe
    130                 135                 140

Lys Cys Pro Glu Gly Lys Ser Asp Gly Gly Tyr Ala Val Ser Ser Tyr
145                 150                 155                 160

Arg Asp Val Asn Pro Ala Leu Gly Thr Ile Gly Asp Leu Arg Glu Val
                165                 170                 175

Ile Ala Ala Leu His Glu Ala Gly Ile Ser Ala Val Val Asp Phe Ile
            180                 185                 190

Phe Asn His Thr Ser Asn Glu His Glu Trp Ala Gln Arg Cys Ala Ala
        195                 200                 205

Gly Asp Pro Leu Phe Asp Asn Phe Tyr Tyr Ile Phe Pro Asp Arg Arg
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Met Pro Asp Gln Tyr Asp Arg Thr Leu Arg Glu Ile Phe Pro Asp Gln
225                 230                 235                 240

His Pro Gly Gly Phe Ser Gln Leu Glu Asp Gly Arg Trp Val Trp Thr
                245                 250                 255

Thr Phe Asn Ser Phe Gln Trp Asp Leu Asn Tyr Ser Asn Pro Trp Val
            260                 265                 270

Phe Arg Ala Met Ala Gly Glu Met Leu Phe Leu Ala Asn Leu Gly Val
        275                 280                 285

Asp Ile Leu Arg Met Asp Ala Val Ala Phe Ile Trp Lys Gln Met Gly
    290                 295                 300

Thr Ser Cys Glu Asn Leu Pro Gln Ala His Ala Leu Ile Arg Ala Phe
305                 310                 315                 320

Asn Ala Val Met Arg Ile Ala Ala Pro Ala Val Phe Phe Lys Ser Glu
                325                 330                 335

Ala Ile Val His Pro Asp Gln Val Val Gln Tyr Ile Gly Gln Asp Glu
            340                 345                 350

Cys Gln Ile Gly Tyr Asn Pro Leu Gln Met Ala Leu Leu Trp Asn Thr
        355                 360                 365

Leu Ala Thr Arg Glu Val Asn Leu Leu His Gln Ala Leu Thr Tyr Arg
    370                 375                 380

His Asn Leu Pro Glu His Thr Ala Trp Val Asn Tyr Val Arg Ser His
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385 390 395 400

Asp Asp Ile Gly Trp Thr Phe Ala Asp Glu Asp Ala Ala Tyr Leu Gly
405 410 415

Ile Ser Gly Tyr Asp His Arg Gln Phe Leu Asn Arg Phe Phe Val Asn
420 425 430

Arg Phe Asp Gly Ser Phe Ala Arg Gly Val Pro Phe Gln Tyr Asn Pro
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Ser Thr Gly Asp Cys Arg Val Ser Gly Thr Ala Ala Ala Leu Val Gly
450 455 460

Leu Ala Gln Asp Asp Pro His Ala Val Asp Arg Ile Lys Leu Leu Tyr
465 470 475 480

Ser Ile Ala Leu Ser Thr Gly Gly Leu Pro Leu Ile Tyr Leu Gly Asp
485 490 495

Glu Val Gly Thr Leu Asn Asp Asp Asp Trp Ser Gln Asp Ser Asn Lys
500 505 510

Ser Asp Asp Ser Arg Trp Ala His Arg Pro Arg Tyr Asn Glu Ala Leu
515 520 525

Tyr Ala Gln Arg Asn Asp Pro Ser Thr Ala Ala Gly Gln Ile Tyr Gln
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Gly Leu Arg His Met Ile Ala Val Arg Gln Ser Asn Pro Arg Phe Asp
545 550 555 560

Gly Gly Arg Leu Val Thr Phe Asn Thr Asn Asn Lys His Ile Ile Gly
565 570 575

Tyr Ile Arg Asn Asn Ala Leu Leu Ala Phe Gly Asn Phe Ser Glu Tyr
580 585 590

Pro Gln Thr Val Thr Ala His Thr Leu Gln Ala Met Pro Phe Lys Ala
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Asp Asp His Gly Leu
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